

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Pond Sealing or Lining

Bentonite Sealant

(Number)

Code 521C

DEFINITION

A liner for a pond or waste impoundment consisting of a compacted soil-bentonite mixture.

PURPOSES

To reduce seepage losses from ponds or waste impoundments for water conservation and environmental protection.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Soils are suitable for treatment with bentonite.
- Ponds or waste impoundments require treatment to reduce seepage rates and to impede the migration of contaminants to within acceptable limits.

GENERAL CRITERIA

Ponds to be sealed shall be constructed to meet NRCS FOTG standards for Irrigation Regulating Reservoirs (552), Irrigation Storage Reservoirs (436), Ponds (378), Waste Treatment Lagoons (359), Waste Storage Facilities (313) or Wildlife Watering Facilities (648), as appropriate. All

work planned shall be in compliance with federal, state, and local laws and regulations.

Soil properties. For bentonite sealing, soils shall have properties approximating the following:

1. Soil with less than 50 percent fines (0.074 mm diameter) (No. 200 sieve).
2. Plasticity Index (PI) less than 7.

The bentonite shall be sodium bentonite with a free swell of at least 22 milliliters as measured by ASTM Standard Test Method D5890, unless laboratory tests using other bentonite types are used in design.

For protection against bentonite dust, personnel on site during bentonite application and mixing shall wear protective clothing and equipment per the manufacture's recommendations for safety.

Liner Protection. The liner shall be protected against desiccation, cracking, the effects of water surface fluctuations, wave action, surface erosion, erosion from pipe inlets, agitation equipment, animals, or items installed through the liner. Protective measures shall be designed into the system to protect the liner for these cases.

All structures shall be fenced for the safety of humans, livestock, wildlife and pets and to

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your state.

protect the liner from damage during construction and after completion.

Additional Criteria for Waste Storage Facilities

Design. Design of bentonite treated soil liners for waste impoundment shall be in accordance with National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D and/or state regulatory requirements. Liners for waste storage facilities shall have a minimum thickness of 12 inches. Laboratory testing is required to determine the application rate of the bentonite, liner thickness and the compaction effort needed during construction.

Liner Protection. As a minimum, at least 6 inches of soil cover shall be placed over the soil-bentonite liner.

Additional Criteria for Ponds

Application Rate. The rate of application shall be based on laboratory tests unless sufficient data are available on the field performance of previously tested soils that are similar in texture and chemical properties to the soils to be sealed.

In the absence of laboratory tests or field performance data on the soils to be sealed, the minimum application per 1-inch thickness of constructed liner shall be:

Pervious Soil Description	Application rate (lb/ft ²)
Silts (ML, CL-ML)	0.375
Silty Sands (SM, SC-SM, SP-SM)	0.5
Clean Sands (SP, SW)	0.625

Liner Thickness. In the absence of more detailed testing and analyses, the minimum compacted liner thickness shall be according to the following table:

Water Depth (feet)	Liner Thickness (inches)
8 or less	6
8.1 – 16	12
16.1 – 24	18
24.1 - 30	24

In addition to the treated liner, at least 2 feet of fine-grained soil shall be placed over fractured rock outcrop or other highly permeable material.

CONSIDERATIONS

Flattening the slopes of the pond or waste storage facility to facilitate compactive efforts during construction should be considered.

A protective compacted soil cover should be considered for protecting the soil-bentonite liner for ponds.

Consider using a flexible membrane liner for sites that have water depths greater than 24 feet.

A minimum thickness of 12 inches is recommended for all areas in the vertical range of water surface fluctuation.

PLANS AND SPECIFICATIONS

Plans and specifications for sealing ponds with bentonite shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

The area to be treated shall be cleared of all vegetation and trash and all stones or other objects of a size to interfere seriously with the operation of compaction equipment. The area shall also be drained and dried. Holes shall be filled.

Sealing chemicals, in a powdered form, should be distributed evenly over the surface to be treated with a drill, seeder, fertilizer spreader or by hand broadcasting. If broadcast by hand, the area should be staked or otherwise marked in grids of 100 square feet.

The sealing material shall be thoroughly mixed as a minimum, into the 6-8 inch layer of soil being treated or to a specific depth. Mixing should be with a rototiller or pulvermixer type equipment. A second mixing should be carried out in a direction perpendicular to the first mixing.

Water should be added by sprinkling during the mixing operation if moisture is not adequate for maximum compaction. If moisture content is too high, the soil should be dried by disking or some other effective process.

Unless laboratory tests indicate differently, each treated layer of soil should be compacted to a dry density of 90 percent or more of maximum standard Proctor with soil at optimum or slightly higher moisture content.

Treated areas shall be protected from puncture by livestock trampling. Areas near the normal water line and at points of concentrated surface flow into the pond shall be protected against erosion. Areas where inflow is concentrated should be protected by riprap or other measures.

On those soils that are highly susceptible to drying cracks, they should be protected with straw mulch to prevent cracking and gullyng of the blanket before the pond fills.

Applications shall be carried out in such a manner that erosion and air and water pollution are minimized. The completed job shall present a professional finish.

OPERATION AND MAINTENANCE

Maintenance activities required for this practice consist of those operations necessary to prevent breaching of the treated soil layer. This includes excluding livestock and equipment from the treated area; protection of the layer during initial filling, agitation, or pumping operations; and repair of disturbed or eroded areas.